

ANNOTATIONES ZOOLOGICAE JAPONENSES  
VOL. X, ARTICLE 29.

On an Interesting Hexactinellid, *Calypstorete  
ijimai* nov. gen. et nov. sp.

By

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*With 1 Plate.*

*(Received Sept. 13, 1924)*

In examining a collection of Hexactinellids in the Museum of Science Faculty, Tokyo Imperial University I have found several specimens of an interesting species, which form the basis for the present paper. In spite of having a close affinity to the genus *Pararete*, the species in question is evidently different from any of this genus in the external feature and also with respect to its spiculation. It seems to me that the differences are of sufficient value to distinguish the present form as a new genus and species. For this I would propose the name of

*Calypstorete ijimai.*

**Diagnosis.**—Stock cup- or trumpet-shaped, made up of numerous tubes almost definitely arranged. Tube-wall fairly thin. Dictyonal framework formed of coarsely roughened beams of 0.015–0.09 mm. thickness; meshes in superior region of sponge body regularly shaped, about 1 mm<sup>2</sup>, while those in inferior region much irregular and smaller, being 0.4×0.6 mm. in dimension. Dictyonal nodes, both dermal and gastral, not swollen; spikes in dermal region mostly finger-like or whip-like, sharply pointed at end, while those in gastral region prominent, ending in an almost or irregularly spherical knob. Dermalia pentactins with a very short distal ray of 0.7–1 mm. length, almost entirely roughened on surface, exclusive of central parts. Scopules three kinds: the first one largest, 0.37 mm. in

length, with geniculated head sending out four divergent, or nearly parallel prongs of 0.08 mm. length, which are conspicuously microspined and terminate in a slight swelling; the second and third much smaller, 0.2–0.25 mm. in length, the former with 10–12 slender, and the latter with 8 terminals, which are all provided with inconspicuously denticulated terminal disc. Discohexaster 58–70 $\mu$  in diameter; principal short, bearing 2 or 3 fine terminals, which form a lily-flower-like perianth. Uncinates three kinds: the first one largest, 2.5 mm. or less in length, irregularly distributed in parenchymal region; the second 0.35 mm. long, slenderly curved, occurring in dermal or subdermal region; the third smallest, generally found in dermalia in association with the first.

**Description.**—The specimens, chiefly serving as basis for this communication, are the following five, all in dried condition.

Specimen	Locality	Date	Collector
A (No. 570)	Outside of Iwadogake, Sagami Sea	May 20, 1900	K. Aoki
B (No. 224)	Homba, South of Iwadogake, Sagami Sea	May 3, 1894	Ditto
C (No. 571)	Ditto	Ditto	Ditto
D (No. 572)	Sagami Sea	1913	Ditto
E (No. 573)	Outside of Iwadogake	March 19, 1906	Ditto

Specimen *A* (Figs 1 and 2). This is the largest of all the specimens before me and preserved in a state almost complete, some upper marginal parts of its body missing. The body is of a large cup-like shape with a moderately long stalk, its upper main portion measuring 60–80 mm. in height and 133 mm. across the almost circular gastral mouth. The stalk is a rounded tubular body of 130–150 mm. height, its diameter varying considerably in different

parts and being about 40 mm. above near the trumpet-shaped body and about 9 mm. below. Proximally the stalk is divided into two branches, forming an irregular plate, the basidictyonal plate, which serve as basis for the attachment of the body to the substratum. Laterally from the main stalk arise two tubular processes of 7-10 mm. diameter, which are numerous subdivided and anastomose to form a large irregular body in association with some other short or long tubular processes, given off from the stalk just beneath the trumpet-shaped body. When looking inside through the gastral mouth, there can be seen some oval or circular openings which represent the communications of the tubular processes with the gastral canals.

Specimen *B*. The specimen, though much smaller than the preceding, appears to be almost definitely developed, so far as its body and spiculation are concerned. The body is cup-shaped, measuring 85 mm. high, inclusive of the stalk, and 95 mm. across the mouth of the gastral cavity which is not a great deal deeper than 32 mm. The dermal surface is roughened, excepting some parts, where the lattice is made up of regularly-rectangular meshes, measuring about 1 mm. or less in side-length.

Specimen *C*. The specimen is of a small cup-like shape and has a height of 105 mm., its trumpet-shaped portion being somewhat laterally compressed and 82 mm. in maximal breadth. The stalk is nearly round in cross section, measuring about 20 mm. in diameter. Extending from just beneath the sponge body to near the middle, the stalk gives off a number of laterally directed tubular processes which become thicker and longer as it proceeds towards the inferior. Some of the processes are extremely long and are attached to the substratum, while some others terminate blindly or are bifurcated near the end, opening to the exterior.

Specimen *D*. Of all the specimens on hand, this is the youngest and smallest, and presents an aspect nearly similar to the specimen *C*, though having tubular processes in less numbers. The body is of

a spherical shape, measuring 65 mm. high and 63 mm. across. Inferiorly it gives rise to four tubular processes, which fuse together side by side, forming two laterally compressed ones, each about 20 mm. across in the superior region and 8-15 mm. near the base. The gastral cavity is represented by a shallow hemispherical depression, which is about 10 mm. deep by about 30 mm. across and is entirely lined by the gastral layer. Its margin is gently reflexed outwards, measuring about 60 mm. in breadth.

Specimen *E*. In spite of its body laterally compressed and elliptical in cross section, this form is closely similar in essential features to the specimen *A*, its dimension being  $78 \times 140$  mm. From the base of the body arise two short stalks, each about 20 mm. in thickness, which fuse together side by side. The stalk sends out on one side two slender tubular processes and on the other numerous downwardly directed oblique branches, some of which may be occasionally fixed to the substratum.

Inspecting the above, it may be said that the main body-part is in a young stage almost circular in cross section and in an older elliptical, while the lower portion irregular in outline. In the fully grown specimen, the greatest breadth is seen in the upper part of the body. In less advanced stages of development, however, the body is of an almost cup-like shape, the broadest part being found at, or near, the middle. It is self-evident that from a certain period onwards, the growth chiefly confines itself either to the upper parts of the body or to the marginal portion of the gastral cavity, the lower portion admitting of little growth, only giving rise to a number of tubular processes.

Specimen	Height of body, inclusive of tubular processes	Height of body, exclusive of tubular processes	Major axis of gastral mouth	Minor axis of gastral mouth	Breadth of stalk just below trumpet-shaped portion	Depth of gastral cavity.
A	130-150 mm.	60-80 mm.	133 mm.	115 mm.	120 mm.	75-85 mm.
B	85 mm.	35-55 mm.	50 mm.	45 mm.	95 mm.	32 mm.
C	105 mm.	55 mm.	55 mm.	32 mm.	82 mm.	40-45 mm.
D	65 mm.	35 mm.	20 mm.	30 mm.	60 mm.	18 mm.
E	113 mm.	65-75 mm.	140 mm.	78 mm.	130 mm.	65 mm.

In most cases the sponge stands in close contact with, or fixed to, the substratum at more than two points, this state of things being brought about by sending out two off-shoots from the originally single stalk, as in the specimen *D*, or of numerous off-shoots, as in the specimen *C*. As development goes on, the off-shoots in the latter case are fused together side by side, or into a ramified condition. Hence it is easy to imagine that the mode of attachment to the substratum varies considerably in different individuals.

The dermal latticework, very fine and discernible with more or less distinctness, is widely spread over the surface of the body, even near the diarthysial openings. In some specimens on hand the dermalia are well preserved, without being abraded. The lattice is in part irregularly meshed and in part more or less regularly quadrate-meshed, measuring on an average 1 mm. in side-length. Near the end of the glove-finger-like diarthysial tubes, where the dermal layer has fallen off, the surface exhibits a roughened appearance on account of the presence of short and delicate dermal spikes, which spring from the centre of the dictyonal crosses and terminate freely just beneath the ectosomal surface. The spikes gradually become longer

towards the deeper parts of the tubes just mentioned, reaching those of the superficial dictyonal skeleton.

Differing in fact from the dermal, the gastral surface presents much smaller and irregular quadrate-meshes, which measure 0.5–0.7 mm. in side-length and are made up of more delicate and short pentactinic paratangentials. In most of the specimens on hand the gastral lattice is well protected from abrading influences, because of situation in the gastral depression. The dermal and gastral surfaces of the sponge body scarcely differ in appearance, their distinction being found in the following two parts: 1) In the dictyonine Hexactinellids in general the spikes are more strongly developed on the dermal than on the gastral side. 2) The quadrate-meshes are of large size and formed of paratangential rays which are much longer and stronger on the gastral than on the dermal surface.

The dermalia are usually pentactins of varying sizes. The largest spicules are irregularly and sparsely distributed; the medium sized ones are regularly arranged, forming the main part of the dermal lattice-work; the smallest are intermingled with the others. All of these pentactins are usually provided with six boss-like rudimentary distal rays, which are prominently tuberculated on the surface. In the largest spicules, the paratangential rays are extremely long and strong, measuring 0.9–0.115 mm. long by 0.06–0.075 mm. at the base and perceptibly tapering to a bluntly or sharply pointed end. Nearly all over the surface there exist conical microspines which gives it a coarsely shagreen-like appearance, excepting near the base of the rays and the central node where they are altogether absent.

The medium sized spicules abundantly occur in the dermal reticular lattice and possess a little shorter and slender rays, the paratangentials, which are 0.45–0.8 mm. in length, as measured from the centre, and 0.03–0.05 mm. in thickness at the base. The distal ray is nearly as long as the paratangential, measuring 0.9 mm. in

length. All the rays gradually taper towards a bluntly pointed end, their surface being weakly and sparsely microspined, except near the base of the rays as well as on the central node. In the dermalia there occur in small numbers the third smallest and slender pentactines of a hexactinic form, their sixth distal ray being highly reduced and represented by a peg- or knob-like process, which is comparatively long, though almost like that in the preceding spicule. All the other rays, exclusive of the sixth distal ray, are scarcely roughened on the surface and generally taper to a pointed end. Their length, as measured from the spicular center, is 0.3–0.45 mm., breadth 0.008–0.015 mm. near the base. They are distributed in association with the other two types, forming quadrate-meshes.

Generally the dermal lattice-work is not in all parts regularly meshed. In some region where the meshes are of an almost quadrate shape, the adjacent paratangentials are, as usual, closely apposed side by side.

**Spiculation.**—In examining chiefly the specimen *C* in reference to the others, the dictyonal framework is of a rather delicate and fragile nature, being made up of almost parallel beams, running for some little distance as strands, as well as of very short, irregularly disposed cross-beams. The cross-beams, though usually perpendicular to the strands, are frequently disposed in oblique direction and often terminate in a sharp point; consequently there is found a mesh-work which is caused usually by quadrate- or rectangular-meshes, or more rarely by round-cornered triangular or trapezoidal. The meshes, though varying in size, generally measure 1 mm. or more in side-length. In sections the meshes are seen arranged in two or three tiers.

In the main part of the skeleton, lying near the gastral region, the dictyonal tissue is tessellated, consisting, as it does, of intersecting fibers irregularly arranged. The sub-rectangular meshes are on an average 0.5 mm. by 0.8 mm. in dimension. In this region the beams

are nearly smooth or sparsely tuberculated, measuring .01–0.15 mm. across. The nodes are not swollen.

The regularity of the mesh-work is frequently disturbed by the occurrence of some beams or strands which are not definite in direction. The strands, running in vertical direction, course in a gentle curve towards the dermal surface. The transverse septa and bridges across the gastral grooves are made up of irregularly reticulated beams, much as in the cortical part of the wall.

The strands are removed from one another, the distance between them being 0.5–0.75 mm. or more. They occur near the base of the sponge body in two or more layers, measuring 0.15 mm. or more in thickness, though near the periphery in a single layer, only 0.1 mm. thick.

The beams are fairly thin, being generally 0.045–0.06 mm. in thickness, and are sparsely or thickly beset on the surface with minute tubercles of a conical shape. From the nodes of intersection, which are not swollen, are given off some spikes, which on the dermal side are slenderly finger-like, strongly curved in various directions and a little more thickly tuberculated than the beams. They are 0.04 mm. in the greatest thickness and not over 0.7 mm. in length. On the contrary, the spikes on the gastral side are feebly developed, being generally of a shape similar to those on the dermal, only excepting their tip which swells out roundly. They are also curved in various directions and thickly microspined on the surface. Near the gastral margin the beams are on the whole delicate and slender, measuring about 0.015–0.035 mm. in thickness. The spikes are not all alike, being finger-like and strongly tuberculated near the external aperture. However, they become much more slender and short inwards and at the same time less conspicuous in tuberculation on the surface.

In the deeper parts of the canals as well as on the gastral wall, the superficial reticulum forms a quite irregular layer, its spikes



being slenderly finger-like, sparsely tuberculated and attaining 0.2 mm. long by 0.04 mm. thick. The connecting beams are very much sparsely tuberculated and not over 0.06 mm. in thickness. Near the blind end of glove-finger-like diarthysial tubes the superficial dictyonal reticulum is in a very retarded state of development, being made up of comparatively slender beams and spikes, which are not often firmly connected together by the cross-beams. The same holds good for the reticulum which makes up the direct wall of the diarthysial canals. The dictyonal skeletons of the tubular processes exhibit a three-dimensional network made up of very strong and densely tuberculated beams of 0.105–0.2 mm. thickness. Some dictyonal meshes are almost quadrate, or rectangular, in shape, measuring 1–1.5 mm. in side-length, while others much irregular, presenting some round corners. The beams are much more densely and prominently tuberculated, as compared with the external beams of the dictyonal skeleton in the upper region of the sponge body. The tubercles are highly conspicuous and of a sharply pointed conical shape. In some parts of the skeleton there are found some distinct spines which, in association with some smaller ones, give the beams a spiny appearance. The nodes appear not to be specially thickened, though they generally represent sexradiate spicular centers. Strongly microtuberculated are the outer spikes, which usually assume a needle-like appearance, and measure 0.21–0.48 mm. in length. Frequently they present a whip-like, or even a fibrous appearance, though by no means uniform in the degree of development and also in direction. Such long spikes, though varying in direction, are generally projected upwards to the dermal membrane.

Frequently from the node which is not thickened and represents a sexradiate spicular centre, arise two or three spikes, which are connected together near the base, to form a simple reticulum.

Frequently within the dictyonal framework there occur irregular hexactins of varying sizes, which are either singly or joined together

and ankylosed to the spike or often to the dictyonal beam. To me it seems that there is no rule in the manner of their arrangement in relation to one another, or to the skeletal parts where they are joined. The hexactins are characterized by being irregularly tuberculated. Frequently the spine is very conspicuously developed. Probably it may sometimes happen that the hexactin assumes a character of a sharpless spiny body, apparently due to the secondary accretion of the siliceous matter.

The scopules may be mentioned under the following four types.

1). The first is the dermal scopules which are tolerably well developed, being 0.37–0.35 mm. in length. Its head usually consists of four straight or very slightly curved prongs which, though a little divergent, are almost parallel and reach 0.08 mm. in length. These prongs are moderately or unusually thick, being thickly beset with very minute barbs and ending in a terminal disc scarcely distinguishable. The shaft bears in the greater part of its length feeble spinules proximally directed, and is 5 or 6  $\mu$  across in the thickest part close to the origin of the prongs.

2). The second is the scopules which occur in abundance in the choanosomal and canalar regions and are of smaller size, measuring 0.2–0.25 mm. in total length. The shaft is 3  $\mu$  thick and nearly smooth on the surface, exclusive of the proximal part, which is tolerably roughened with microtubercles. The end-prongs are 0.33–0.35 mm. in length and are six in number to each scopule, forming a tuft of an elongate conical shape. The prongs are slender, perceptively tapering towards the terminal disc and being gently curved outwards near the extremity. Exclusive of the basal parts, they present on the surface a faintly roughened appearance, this state becoming more or less distinct towards the terminal point. In thickness the prongs may attain 3  $\mu$  at the middle and 12  $\mu$  in the basal region between the end of the prongs and the stalk. The termination is represented by a disc which is quite small and inconspicuous, so that unless using a

high power of the microscope, one cannot see the prongs with blunt end.

3). The third is the scopules which, though differing in the number of the terminal prongs, are nearly similar in size and shape to the second. They are more numerous than the preceding in the choanosome and also abundantly occur in the canalar or the subdermal region. The scopules range from 0.22 mm. to 0.27 mm. in length. The shaft is as thick as that of the preceding, being either nearly smooth or finely roughened. The head usually consists of 12 or 14, slightly curved prongs which are almost parallel, though a little divergent. The prongs are thickly beset with minute barbs and terminate in a scarcely distinguishable disc. The scopule, though sometimes simply thickened, exhibits in most cases an annular swelling or four cruciately disposed knobs, each receiving the extension of the axial canal.

Just as in the scopule, the uncينات comprise the following four types.

1). The uncينات of the first type are those which are of a very large oxea-like shape and abundantly occur disposed in the periphery of the body either in a position vertical, or perpendicular, to the dermal surface or scattered in the choanosome. Occasionally they are found placed more or less vertically to the canalar wall, though not showing any definite manner of their occurrence. Frequently they do not form strong and compact bundles. Length 2.5 mm. or less; greatest thickness 0.015-0.02 mm. The barbs are rather strongly developed, arising from the surface of the shaft a little more divergent than as usual.

2). The second type is of small size and abundantly occurs scattered in the superficial region of the gastral cavity. They are nearly spindle-like in shape and measure 0.2-0.35 mm. in length and about 0.012 mm. in thickness at the middle. Their surface, though usually nearly smooth, is sometimes weakly barbed and sometimes

presents an indication of barbation in the manner of minute bracket-like incisions. Noteworthy is it that the uncinates of this type exhibit a nodular thickening at a point 0.13–0.15 mm. from the thick end, which measures about 0.005 mm. across. Fig. 23 shows a nodular thickening of a common young uncinata.

3). In the third type the uncinates are of nearly equal size, measuring 0.3 mm. or more in length and 0.015 mm. in thickness, and are found occurring in fair abundance, together with those of the second type, in a position perpendicular to the gastral surface. Though differing in the absence of nodular thickening, they are similar in appearance to those of the second type, being beset with minute, rather dense barbs, which are closely appressed against the shaft. Probably the uncinates of this and the second type appear to pass gradually over to each other by a number of intermediate forms.

4). The uncinates of the fourth type are found only in the present species; they are met with only sporadically in some preparations but not in all. The uncinates in question are slender, long and feebly developed, measuring generally 0.5–0.7 mm. long by 0.002 mm. across in the thickest part, and being found irregularly in the subdermal or in the dermal region of the Specimen No. 572. As compared with either of the foregoing types, the shaft is much slender and irregularly curved towards the end. Though appearing almost smooth throughout under a low power of magnification, a close examination has revealed the fact that the shaft is provided on the surface with a series of barbs scarcely developed. In spite of the barbs much smaller as compared with those of the ordinary uncinates, the grooves are well developed as usual and give the shaft a bracket-step-like appearance.

The hexasters are composed of two kinds, a large hexasterous and a small hexactinose discohexaster, the former being found commonly in all parts of the sponge tissues, the latter rarely in the dermal tissues.

The hexasterous discohexaster measures 0.06–0.08 mm. in diameter, its principals bearing usually two, or more rarely one or three, terminals and being each about 0.011 mm. across. The principals are generally somewhat larger in the subdermal region than elsewhere, measuring from 0.075 mm. to 0.08 mm. in diameter. Generally the terminals are slender, fairly bent and almost smooth on the whole surface, though at seldom sparsely beset, throughout their length, with retroverted microtubercles. The convex terminal disc is edged with 4–6 minute recurved teeth.

Interesting is it to note that the spicules of the hexactinose type, which the late Professor Ijima observed in all the Lyssacine Hexactinellids, are rarely found in the dermal region of the present form. In this spicule the axial cross is highly reduced, being represented only by the spicular center and the basal parts of the rays corresponding to the original principals. The terminals look very much like those of the normally developed discohexasters, being much more slender than the normal hexasterous forms and obsoletely rough or nearly smooth on the surface. Their terminal disc, though fewer in number, is nearly similar in appearance to those of the discohexaster. The axial length may reach 0.05 mm.

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## Explanation of Plate.

- Fig. 1. Lateral view of entire sponge body.  $\times \frac{1}{2}$ .  
 Fig. 2. Superior aspect, showing gastral cavity.  $\times \frac{1}{2}$ .  
 Fig. 3. Macerated body-part, its lattice-work having entirely fallen off.  $\times 1$ .  
 Fig. 4. Gastral lattice-work.  $\times 1$ .  
 Fig. 5. The same of younger specimen.  $\times 1$ .  
 Fig. 6. Dermal lattice-work well preserved.  $\times 1$ .  
 Fig. 7. Dermal hexactinic pentactin with prominent distal knob-like ray.  $\times 100$ .  
 Fig. 8. The same with much shorter proximal ray.  $\times 100$ .  
 Fig. 9. Hexactinic discohexaster.  $\times 300$ .  
 Fig. 10. Common discohexaster.  $\times 300$ .  
 Fig. 11. Basidictyonal plate with stauractins.  
 Fig. 12. Dictyonal skeleton forming regularly quadrangular network; dermal aspect.  $\times 20$ .  
 Fig. 13. Dictyonal skeleton, showing gastral spikes which entirely differ in shape from dermal; gastral view.  $\times 20$ .  
 Fig. 14. Gastral spikes assuming a much irregular form in connection with neighbouring ones.  $\times 20$ .  
 Fig. 15. Very slender, delicate uncinates, rarely occurring in dermal region.  $\times 20$ .  
 Fig. 16. Robuster pentactin found in superior region of tubular process.  
 Fig. 17. Gastralia joined together with neighbouring ones, forming a strong and regularly quadrangular network; outer view.  $\times 17$ .  
 Fig. 18. Largest scopule, commonly occurring in dermal and gastral regions.  $\times 300$ .  
 Fig. 19. Small scopule with 11-12 terminals and small bosses on swollen part of basal stalk.  $\times 300$ .  
 Fig. 20. Small scopule with 12 terminals, but without small bosses on top of basal stalk.  $\times 300$ .  
 Fig. 21. Younger stage of small scopule just mentioned above.  
 Fig. 22. Large scopule with 8, fairly divergent terminals.  $\times 300$ .  
 Fig. 23. Smallest uncinata found in abundance on dermalia.  $\times 500$ .  
 Fig. 24. The same.  $\times 950$ .  
 Fig. 25. Small uncinata of almost similar size to former, found together with them in the same region.  $\times 500$ .  
 Fig. 26. Slender, delicate uncinata, shown in Fig. 15.  $\times 150$ .  
 Fig. 27. The same, its lateral spines being much reduced.  $\times 1340$ .  
 Fig. 28. Terminal portion of a large uncinata which abundantly occurs in the inner region of dictyonal skeleton.  $\times 300$ .  
 Fig. 29. Middle part of the same uncinata.  $\times 300$ .  
 Fig. 30. Septal skeleton of tubular process in lateral parts of sponge body; inner aspect.  $\times 50$ .  
 Fig. 31. The same; outer aspect.  $\times 50$ .  
 Fig. 32. The same, showing two or three spikes joined together to assume an irregular shape; inner view.  $\times 50$ .